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(पहला पुनरीक्षण)

Indian Standard

RESPIRATORY PROTECTIVE DEVICES — DEFINITIONS, CLASSIFICATION AND NOMENCLATURE OF COMPONENTS

(First Revision)

ICS 01.040.13; 13.340.30

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 10

Occupational Safety and Health and Chemical Hazards Sectional Committee, CHD 8

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Occupational Safety and Health and Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

This standard refers to respiratory protective devices. It contains definitions for commonly used terms of this area. The object of this standard is to achieve a uniform interpretation of these terms in order to prevent ambiguous use of them. The object is to describe a general classification for a logical grouping of the respiratory protective devices and to avoid confusion and achieve uniform interpolation of such components.

This standard was first published in 1977 taking assistance from AS CZ 11-1968 'Respiratory protective devices', BS 4275 : 1968 'Recommendation for the selection, use and maintenance of respiratory protective equipment' and ANSI Z 88.2-1969 'Practices for respiratory protections'. The concerned technical committee felt the need to revise this standard based on the experiences gained and the technological developments in the last two and a half decades in this area. During this revision, this standard has been made compatible with IS 9623 : 2007 'Selection, use and maintenance of respiratory protective devices — Code of practice (*first revision*)'. Considerable assistance has been derived from the following EN standards during the revision:

EN 132 : 1999	Respiratory protective devices; Definitions of terms and pictograms
EN 133 : 2001	Respiratory protective devices; Classification
EN 134 : 1998	Respiratory protective devices; Nomenclature of components
EN 135 : 1999	Respiratory protective devices; List of equivalent terms

The composition of the Committee responsible for the formulation of this standard is given at Annex B.

Indian Standard

RESPIRATORY PROTECTIVE DEVICES — DEFINITIONS, CLASSIFICATION AND NOMENCLATURE OF COMPONENTS

(First Revision)

1 SCOPE

This standard covers nomenclature of components in respiratory devices. It specifies a classification of the environment where the use of respiratory protective devices may be necessary and a classification of respiratory protective devices according to their design. The standard defines the commonly used terms and pictograms of this area. The natural composition of air and the requirements for the purity of breathable air are given in Annex A.

2 REFERENCE

The following standard contains provision, which through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
9623 : 2007	Selection, use and maintenance of respiratory protective devices — Code of practice

3 TERMINOLOGY

3.1 Aerosol — Suspension of solid, liquid or solid and liquid particles in a gaseous medium, having a negligible falling velocity (generally considered to be less than 0. 25 m/s).

3.2 Air Supply Hose — Hose delivering air at about atmospheric pressure.

3.3 Assisted — Describes a filtering device or a fresh air hose breathing apparatus in which air is delivered to the facepiece by an assisting device.

3.4 Atmospheres or Conditions Immediately Dangerous to Life — A situation that possesses a threat of exposure to airborne contaminant, when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

3.5 Blouse — Garment, used as a facepiece which covers the head and upper part of the body to the waist and wrists and to which air is supplied.

3.6 Body Harness — Means to enable a user to wear certain components of a respiratory protective device (RPD) on the body.

3.7 Breakthrough Concentration — Concentration of test gas in effluent air at which a gas filter undergoing test is deemed exhausted.

3.8 Breathable Air — Air of a quality that makes it suitable for safe respiration (*see* Annex A).

3.9 Breathing Apparatus — Apparatus which enables the wearer to breathe independently of the ambient atmosphere.

3.10 Breathing Apparatus for Use in Abrasive Blasting Operations — Breathing apparatus incorporating a protective hood or a blouse fitted with an impact resistant visor. Breathing air is supplied to the wearer from a source of air not carried by the wearer.

3.11 Breathing Hose (Low Pressure) — Flexible, for instance corrugated, hose connected to the facepiece through which breathable air enters at atmospheric pressure or at a pressure slightly above or below atmospheric pressure.

3.12 Breathing Resistance — Resistance of a respiratory protective device to the flow of air during inhalation (Termed Inhalation Resistance) or exhalation (Termed Exhalation Resistance).

3.13 Checking Device — A device to enable the user to check that the manufacturers minimum design air flow rate or minimum design conditions are achieved or exceeded.

3.14 Chemical Filter — A container with either a filter, sorbent or catalyst, or a combination of these items, which removes specific gaseous and vapour contaminant(s) from the atmosphere passed through the container.

3.15 Clogging — Accumulation of particles on a filter with consequent increase in its resistance to flow.

3.16 Combined Filter — Filter intended to remove dispersed solid and/or liquid particles and specified gases and vapours from the flow of air passing through it.

3.17 Compressed Air Filter — Filter intended to remove dispersed solid and/or liquid particles and specified gases and vapors from compressed air passing through it.

3.18 Compressed Air Line Breathing Apparatus — Apparatus which is not self-contained and in which the facepiece supplied with breathable air from a source of compressed air.

3.19 Contaminant — Undesirable solid, liquid or gaseous substance in the air.

3.20 Continuous Flow Valve — Valve which allows the wearer of a breathing apparatus to regulate a continuous air flow within prescribed limits.

3.21 Demand Type — A type of respiratory protective device which is fitted with a demand valve governed by the breathing action of lungs.

3.22 Demand Valve — A valve governed by the breathing action of lungs, supplying the breathable gas on demand.

3.23 Disposable Respirator — A device for which maintenance is not intended and which is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage or end of service life renders it unsuitable for use.

3.24 Dust — General term denoting solid particles (*see also* Fume and Smoke).

3.25 End of Service Life Indicator — A system that warns the user of the approach of the end of adequate respiratory protection.

3.26 Escape-Type Respiratory Protective Device — Respiratory protective device to be used only during escape from hazardous atmospheres.

3.27 Exhalation Valve — Non-return valve which allows the escape of exhaled and excess air from the facepiece.

3.28 Exhaled Air — Air breathed out by the wearer.

3.29 Face Blank — The main body of a facepiece to which the functional components are attached.

3.30 Facepiece — The part of a respiratory protective device which connects the wearer's respiratory tract to other parts of the device and isolates the respiratory tract from ambient atmosphere. Facepieces may be full face masks, half masks, quarter masks, mouthpiece assemblies, filtering facepieces. Helmets, hoods, blouses and suits may serve the same purpose.

3.31 Facepiece Incorporating Head Protection — A facepiece incorporating head protection comprises a facepiece either attached to or integrated with a safety helmet.

3.32 Face Seal Leakage — Inward leakage of the ambient atmosphere between the face and the facepiece, when measured in the laboratory in the specific test atmosphere. It is expressed as a percentage of total inhaled air.

3.33 Filter — Device intented to remove specific contaminants from the ambient air passing through it.

3.34 Filter Housing — Component which is attached to either a facepiece or other part of the device and into which a filter, either encapsulated or unencapsulated, is inserted.

3.35 Filtering Device — Respiratory protective device in which air passes through filter(s) before being inhaled. The device may be unassisted or powered.

3.36 Filtering Facepiece or Filtering Half Mask — Facepiece entirely or substantially constructed of filter material.

3.37 Fog — An atmosphere in which visibility is reduced because of a cloud of some substance.

3.38 Fresh Air Hose Breathing Apparatus — Respiratory protective device in which breathable air is obtained through an air supply hose either assisted or unassisted.

3.39 Full Face Mask — A tight fitting facepiece covering mouth, nose, eyes and chin.

3.40 Fume — Fine solid aerosol which may be chemically generated or of metallic origin.

3.41 Gas Filter — Filter intended to remove specific gases and vapours from atmospheres passing through it.

3.42 Half Mask — A tight fitting facepiece covering mouth, nose and chin.

3.43 Hazardous Atmosphere — An atmosphere that contains a contaminant in excess of its permissible exposure level or that is oxygen deficient.

3.44 Head Harness — Means of holding a facepiece in place on the head.

3.45 Helmet — A part of respiratory protective device used as a facepiece offering head protection.

3.46 High Pressure — Pressure between the source of compressed gas and pressure reducer, normally over 100 bar.

3.47 Hood — A loose fitting facepiece which covers at least the face, and may cover the entire head.

3.48 Hose — A hollow conduit to carry air at or around ambient pressure.

3.49 Immediately Dangerous to Life or Health (IDLH) Level — Any atmosphere that poses an immediate hazard to life or poses immediate irreversible debilitating effects on health or impairs the ability to escape.

3.50 Inhalation Valve — Non-return valve which allows breathable gas to enter the facepiece and prevents exhaled air from leaving via the same inlet path.

3.51 Inhaled Air — Air breathed in by the wearer.

3.52 Loose Fitting Facepiece — A respiratory inlet covering that is designed to form a partial seal with the face, does not cover the neck and shoulders and may or may not offer head protection against impact and penetration.

3.53 Low Pressure — Pressure within a facepiece or in a breathing hose directly connected to the facepiece, approximately ambient atmospheric pressure.

3.54 Lung Governed Demand Valve — A valve for a breathing apparatus by which air supply is regulated in accordance with the wearers breathing.

3.55 Manufacturers Design Duration — The time as stated by the manufacturer, for which the manufacturer, for which the manufacturer's minimum design flow rate is exceeded.

3.56 Manufacturer's Minimum Design Condition — The lowest level of operating conditions of the device as stated by the manufacturer at which the complete device will still meet the requirements for the designated class.

3.57 Manufacturer's Minimum Design Flow Rate — The minimum airflow rate, as stated by the manufacturer at which the class requirements are met.

3.58 Medium Pressure — Pressure between a demand valve and a pressure reducer or upstream of a continuous flow valve, normally 2 bar to 10 bar gauge pressure.

3.59 Medium Pressure Connecting Tube — A tube connecting the demand valve or the control valve with the air supply system at medium pressure.

3.60 Minute Volume -- Volume of air inhaled in one minute.

3.61 Mist — General term denoting liquid aerosols.

3.62 Mouthpiece Assembly — Device held by the teeth, sealing against the lips and through which air is inhaled and exhaled while the nose is closed by a clip.

3.63 Multiple Filters — Constructions where the full air flow for a respiratory protection device is divided between two or more filters.

3.64 Multitype Gas Filter — Gas and vapor filters which meet the requirements of more than one type of gas filter.

3.65 Negative Pressure Respirator — A respirator in which the air pressure inside the respiratory inlet covering is less than the ambient air pressure during inhalation.

3.66 Nominal Protection Factor — Ratio of the concentration of contaminant present in the ambient atmosphere to its concentration in the air inhaled by the wearer of a respiratory protective device, calculated at maximum permitted inward leakage in prescribed tests.

3.67 Nose Clip — A device designed to occlude the nostrils to prevent air inhalation. Used in conjunction with mouthpiece.

3.68 Nuisance Dusts — These dusts may dissolve and pass into the blood stream or may remain in the lungs either producing local or systemic effects. Dust or grain, flour, wood, etc, are common examples. But these dusts may cause irritation or produce allergy.

3.69 Oxygen Deficient Air — Describes air containing oxygen below 17 percent by volume (dry air) where filtering devices cannot be used.

3.70 Particle — Solid or liquid substance in the finely divided state.

3.70.1 *Inhalable* — The mass fraction of particles which can be inhaled by nose or mouth and have a 50 percent cut-point of 100 µm. These particles may be hazardous when deposited in the head airway region.

3.70.2 *Respirable* — The mass fraction of particles that reaches the alveoli; It has been shown that 50 percent of the particles with an aerodynamic diameter of 4 µm belong to the respirable fraction.

3.70.3 *Thoracic* — The mass fraction of particles that passes the larynx; it has been shown that 50 percent of the particles in air with an aerodynamic diameter of 10 µm belong to the thoracic fraction.

3.71 Particle Filter — Filter which is intended to remove airborne particles.

3.72 Particulate — The generic name of dusts, mists, smoke and fumes.

3.73 Pendulum Type Respiratory Protective Device — Respiratory protective device in which the wearer alternatively inhales and exhales by the same route.

3.74 Permissible Exposure Level — Permissible exposure limit is a time-weighted average (TWA) or absolute value setting out the maximum permitted exposure to a hazardous chemical/substance.

3.75 Poor Warning Properties — A substance whose odour, taste, or irritation effects are not detectable or not persistent at concentrations at or below its permissible exposure level.

3.76 Positive Pressure Respirator — A respirator in which the pressure inside the respiratory inlet covering is higher than the ambient air pressure.

3.77 Powered Filtering Devices (Turbo Filtering Device) — Filtering device in which air is delivered to the facepiece, hood or helmet by means of a blower worn by the wearer. The letters *T* can be used for Turbo and *H* for Hood in its classification.

3.78 Pre-filter — Filter which removes coarse particles, situated in front of the main filter.

3.79 Pressure Gauge — Pressure indicator giving the pressure in a part of an apparatus.

3.80 Pressure Reducer — Device which reduces pressure to a lower pressure.

3.81 Protection Factor — Ratio of the concentration of contaminant present in the ambient atmosphere to its concentration in the air inhaled by the wearer of a respiratory protective device.

3.82 Quarter Mask — A tight fitting facepiece covering mouth and nose.

3.83 Radionuclide — An atom that spontaneously emits atomic particles (proton, electron, neutron) gamma or X-ray radiation.

3.84 Respirator — A personal protective device to protect the user from inhalation of hazardous atmosphere.

3.85 Respirator Inlet Covering — The portion of a respirator that connects the user's respiratory tract to a filter (air purifying device) or a respirable gas source or both. It may be a facepiece, helmet or hood. It serves as a barrier against the contaminated atmosphere and as a framework to which air purifying or air supplying elements may be attached.

3.86 Respiratory Protective Device (RPD) — Personal protective equipment designed to protect the wearer's respiratory tracts against inhalation of atmospheres that would normally cause adverse health effects.

3.87 Self-Contained Breathing Apparatus — Breathing apparatus where the breathing gas supply is carried by the wearer.

3.87.1 *Self-Contained Closed-Circuit Oxygen Breathing Apparatus* — Self-contained breathing apparatus which removes carbon dioxide from the exhaled air and adds oxygen to the inhaled air for breathing by the wearer and is independent of the ambient atmosphere.

3.87.2 *Self-Contained Open-Circuit Compressed Air Breathing Apparatus* — Self-contained breathing apparatus which has a portable supply of compressed air and is independent of the ambient atmosphere. The exhaled air passes without recalculation to the ambient atmosphere.

3.88 Service Life — The period of time that a respirator provides adequate protection to the user.

3.89 Smoke — General term denoting an aerosol generated by incomplete combustion.

3.90 Sorbent — Filter medium which captures gases by chemical or physical means.

3.91 Spray — Mechanically produced liquid particles with sizes generally in the visible or microscopic range.

3.92 Suit — Garment which covers the whole body to wrists and ankles and to which breathing air is to be supplied.

3.93 Threshold Limit Value (TLV) — Air-borne concentration of toxic substances and represents conditions under which it is believed that nearly all workers may by repeatedly exposed day after day without adverse effect.

3.94 Tight Fitting Facepiece — A respiratory inlet covering that is designed to form a complete seal with the face such as a half-face mask and full-face mask.

3.95 Time Weighted Average (TWA) — The concentration of a contaminant in air determined by adding together the products of each concentration and the corresponding time over which that concentration was measured, and dividing the sum by the total time over which the measurements were taken.

3.96 Units for Gas and Vapour Concentrations — Gas concentrations in this standard are expressed in parts per million (ppm) by volume. The following formula can be used to convert from ppm to mg/m^3:

$$\begin{array}{c}\text{Concentration}\\ \text{in mg/m}^3\end{array} = \frac{\text{Molecular weight} \times \text{Concentration in ppm}}{24.4}$$

where

24.4 = molar volume in litres at 25°C and 101.3 kPa.

It should be noted that gravimetric units of mg/m^3 are affected by temperature and pressure variations and, when used in this standard, are expressed relative to standard conditions of 25°C and 1 atmosphere (atm), where 1 atm = 101.3 kPa.

3.97 Vapour — Gaseous phase of a substance which is liquid or solid at 20°C and 1 bar (absolute).

3.98 Visor — The part of the facepiece which can also provide face protection and may be present in a respiratory protective device and which gives maximum field of vision for that particular respirator.

3.99 Warning Device — A device to inform the user that the respiratory protection device will soon stop or has already stopped operating at the desired conditions.

3.100 Water Based Aerosol — Aerosols produced from solutions and/or suspensions of particulate materials in water such that the only workplace contaminant is attributed to this solid material.

4 CLASSIFICATION

4.1 General

The environment may be contaminated by particles and/or by gases and vapours. There may also be an oxygen deficiency. Temperature and humidity are also to be taken into consideration. Different types of environment as encountered in general are given in Fig. 1.

4.2 Classification of Respiratory Protective Devices

There are two distinct methods of providing personal respiratory protection — either by purifying the ambient air to be breathed using filters able to remove contaminants in the air through filtering devices or by supplying the wearer with breathable gas from an uncontaminated source through respiratory protective device called breathing apparatus.

Respiratory protective devices can thus be categorized into following two types based on the methods of providing personal respiratory protection against contaminated atmospheres (*see* Fig. 2):

a) *Filtering Facepiece Devices* — By purifying the air
b) *Breathing Apparatus* — By supplying breathable air from an uncontaminated source

4.3 Filtering Devices

Filtering devices remove contaminants from the ambient air by filtration and can only protect against limited concentration ranges of known contaminants in air if a suitable filter and facepiece are chosen.

4.3.1 *Types*

The facepiece can be a mask, filtering facepiece, hood, mouthpiece, helmet, etc. The airflow through the filter(s) may be assisted or unassisted. The means of supplying breathable gas may consist of pressure cylinders, compressed air line system, fresh air supply system or another suitable supply system.

Air which is to be inhaled passes through a filter to remove contaminants. The filtering devices can be divided into following three grades unassisted or power-assisted:

a) *Particle Filter* — For protection against particles,
b) *Gas Filter* — For protection against gases and vapours, and
c) *Combined Filter* — For protection against particles and gases/vapours.

Filtering devices do not give protection against oxygen deficiency.

4.3.2 Particle filters are divided into the following classes:

a) Low efficiency filters,
b) Medium efficiency filters, and
c) High efficiency filters.

NOTE — Low, medium and high efficiency filters are graded according to their ability to remove solid and liquid or solid particles only.

4.3.3 Gas filters are divided into the following classes:

a) Low capacity filters,
b) Medium capacity filters, and
c) High capacity filters.

NOTE — Gas filters are further divided into types according to the gases they protect against, for example, filter Types A, B, E or K.

4.3.4 The different varieties of filtering devices are given in Fig. 3.

4.4 Breathing Apparatus

The main types of breathing apparatus are represented in Fig. 4.

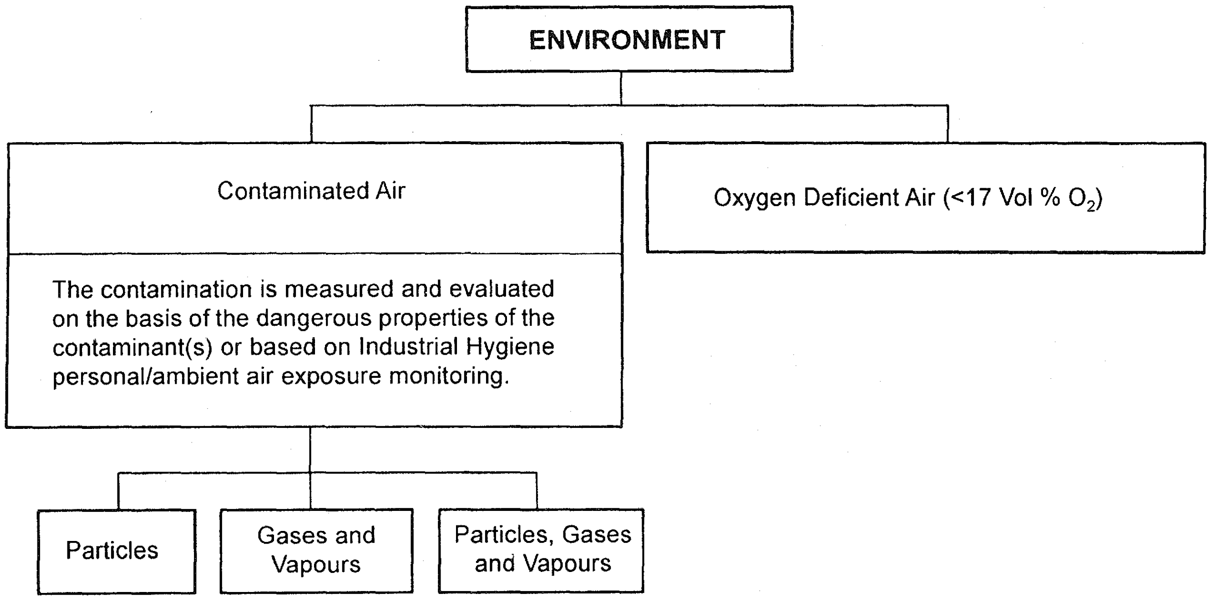

ENVIRONMENT
Contaminated Air
The contamination is measured and evaluated on the basis of the dangerous properties of the contaminant(s) or based on Industrial Hygiene personal/ambient air exposure monitoring.
Oxygen Deficient Air (<17 Vol % O2)
Particles
Gases and Vapours
Particles, Gases and Vapours

FIG. 1 DIFFERENT TYPES OF ENVIRONMENT

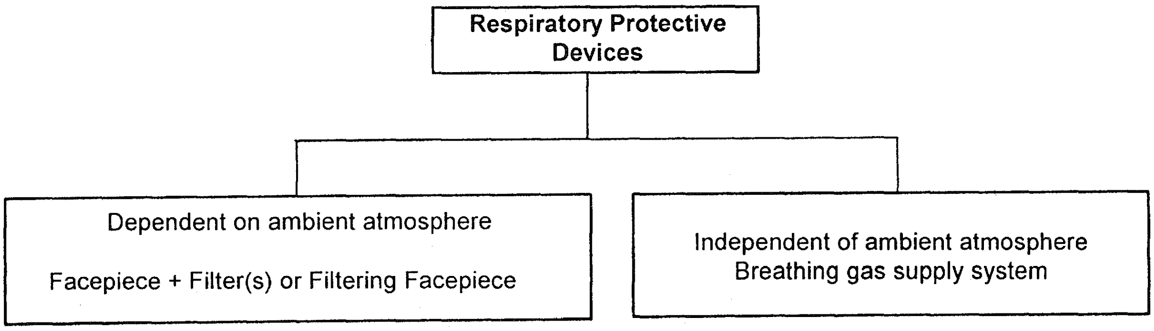

Respiratory Protective Devices
Dependent on ambient atmosphere
Facepiece + Filter(s) or Filtering Facepiece
Independent of ambient atmosphere
Breathing gas supply system

FIG. 2 CLASSIFICATION OF RESPIRATORY PROTECTIVE DEVICES

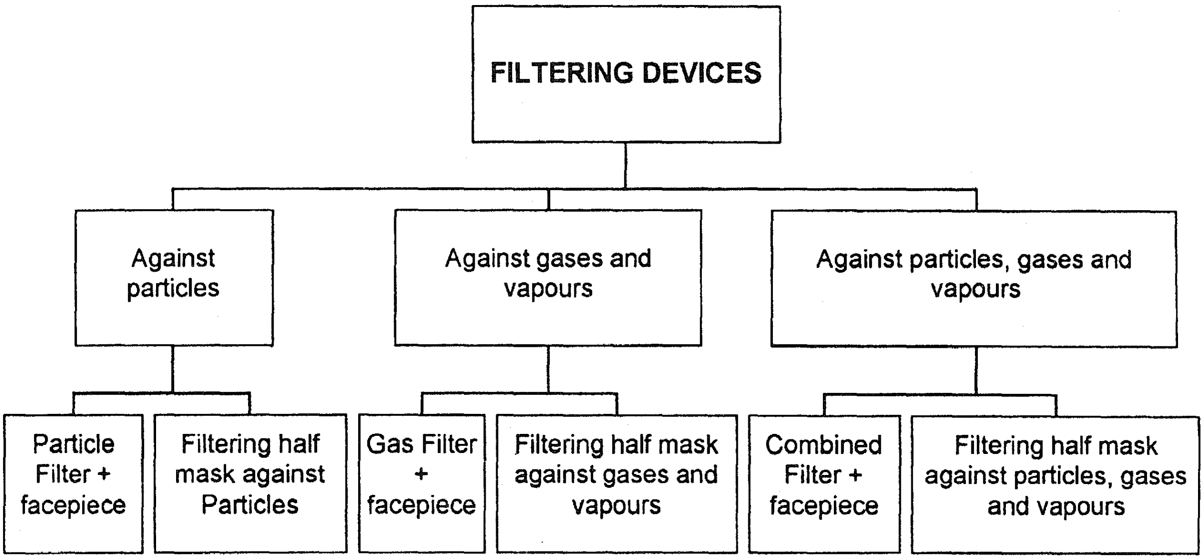

FILTERING DEVICES
Against particles
Against gases and vapours
Against particles, gases and vapours
Particle Filter + facepiece
Filtering half mask against Particles
Gas Filter + facepiece
Filtering half mask against gases and vapours
Combined Filter + facepiece
Filtering half mask against particles, gases and vapours

FIG. 3 FILTERING DEVICES

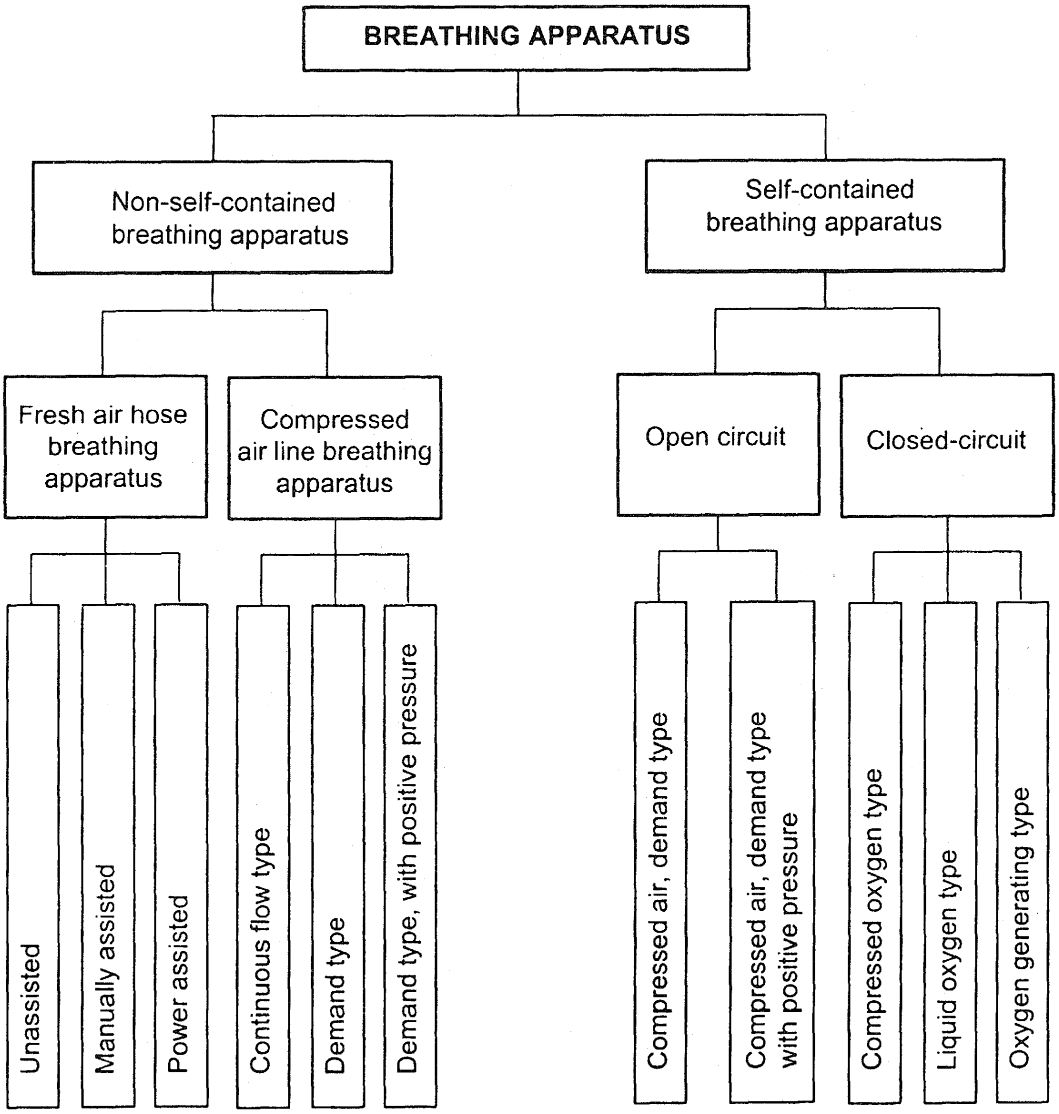
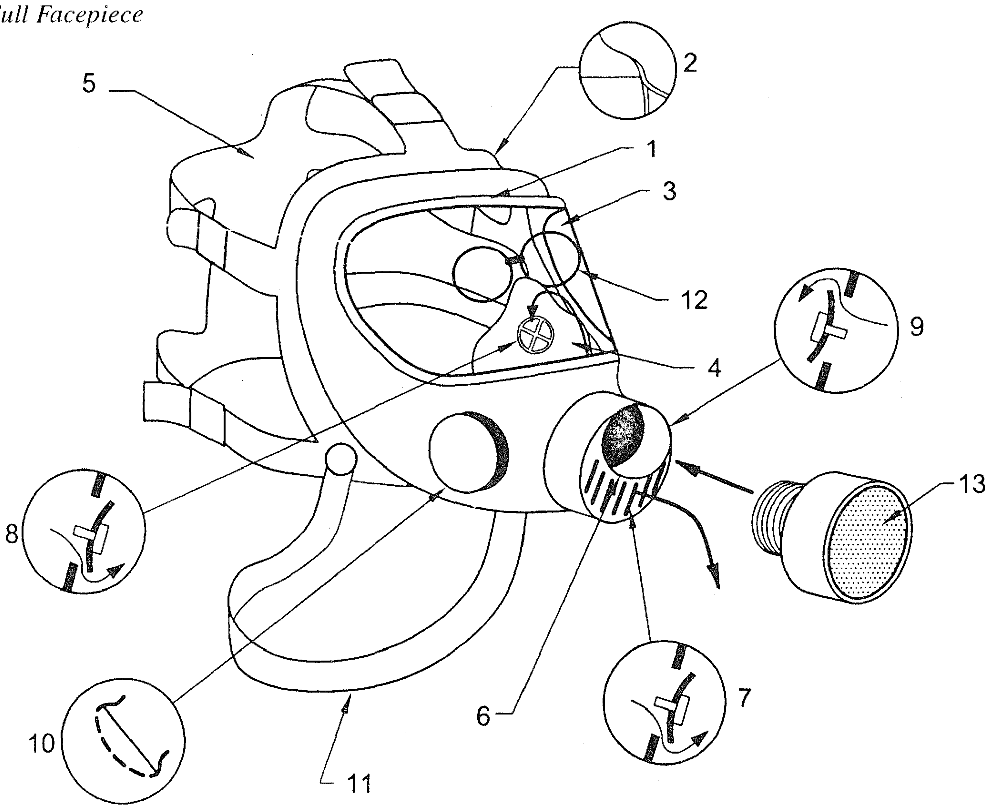

BREATHING APPARATUS
Non-self-contained breathing apparatus
Self-contained breathing apparatus
Fresh air hose breathing apparatus
Compressed air line breathing apparatus
Open circuit
Closed-circuit
Unassisted
Manually assisted
Power assisted
Continuous flow type
Demand type
Demand type, with positive pressure
Compressed air, demand type
Compressed air, demand type with positive pressure
Compressed oxygen type
Liquid oxygen type
Oxygen generating type

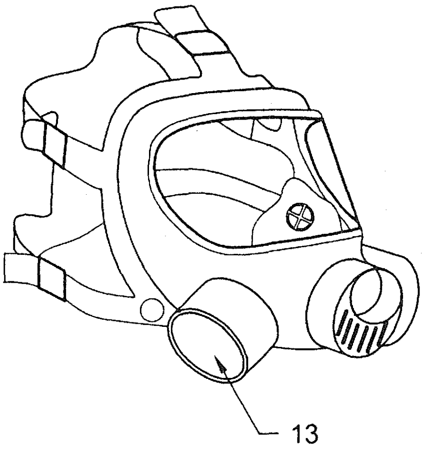
FIG. 4 BREATHING APPARATUS

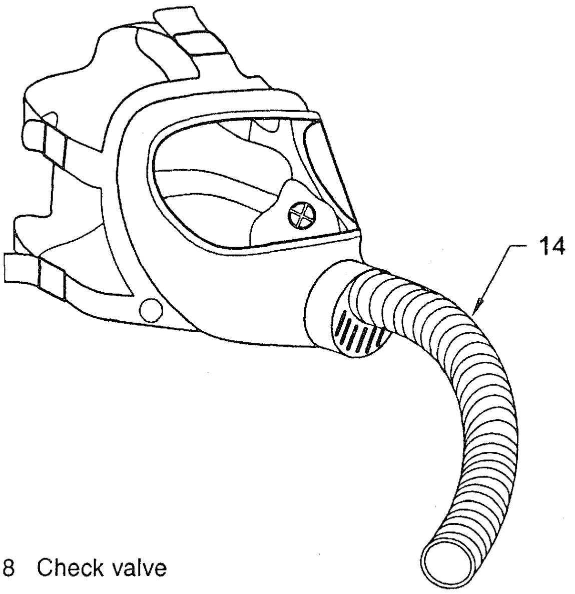
5 NOMENCLATURE

5.1 Facepieces

5.1.1 *Full Facepiece*

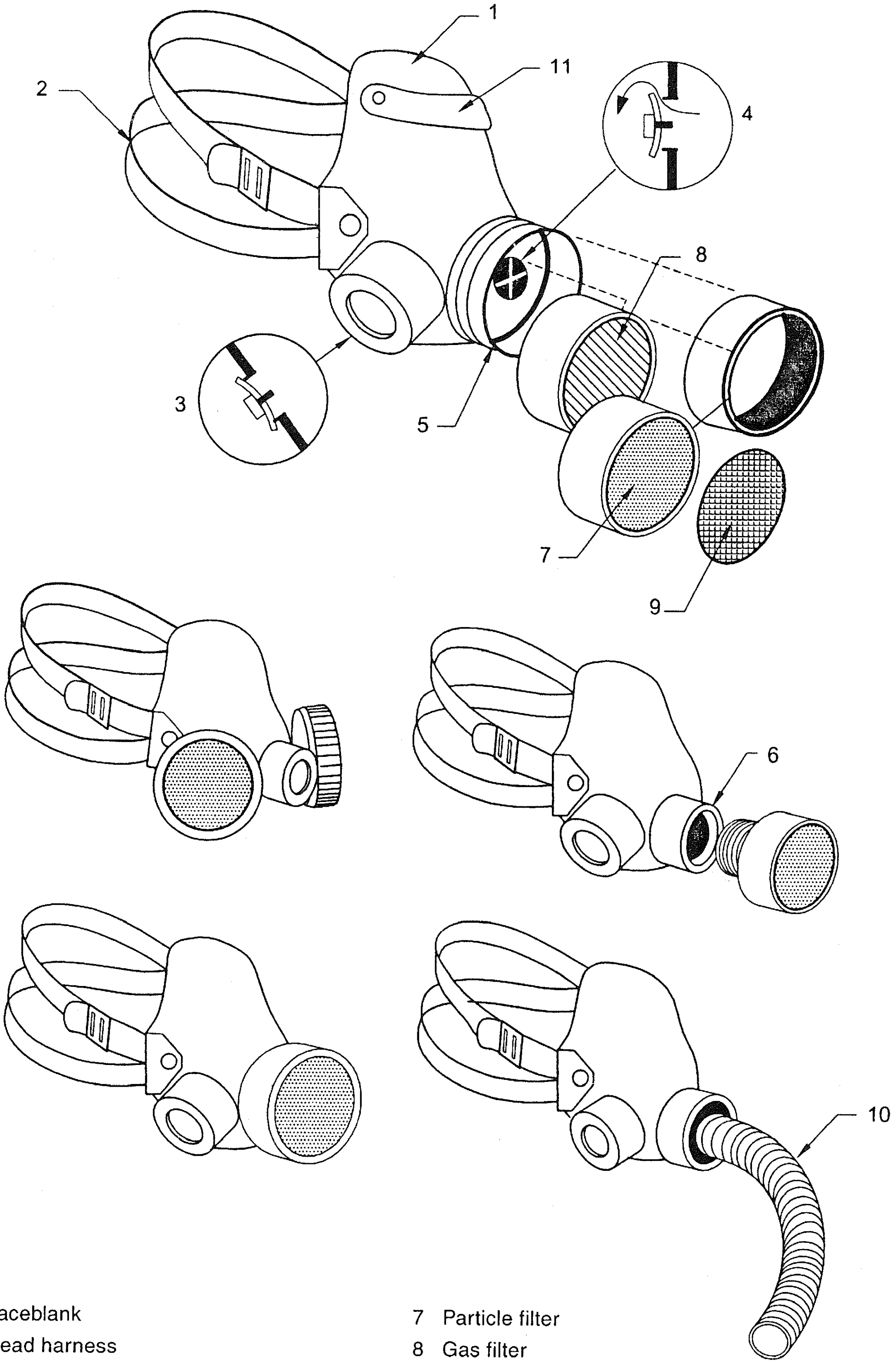






1	Faceblank	8	Check valve
2	Facepiece seal	9	Inhalation valve
3	Visor	10	Speech diaphragm
4	Inner mask	11	Neck strap (Carrying strap)
5	Head harness	12	Spectacles (Kit — Optional)
6	Equipment connector	13	Filter
7	Exhalation valve	14	Breathing hose

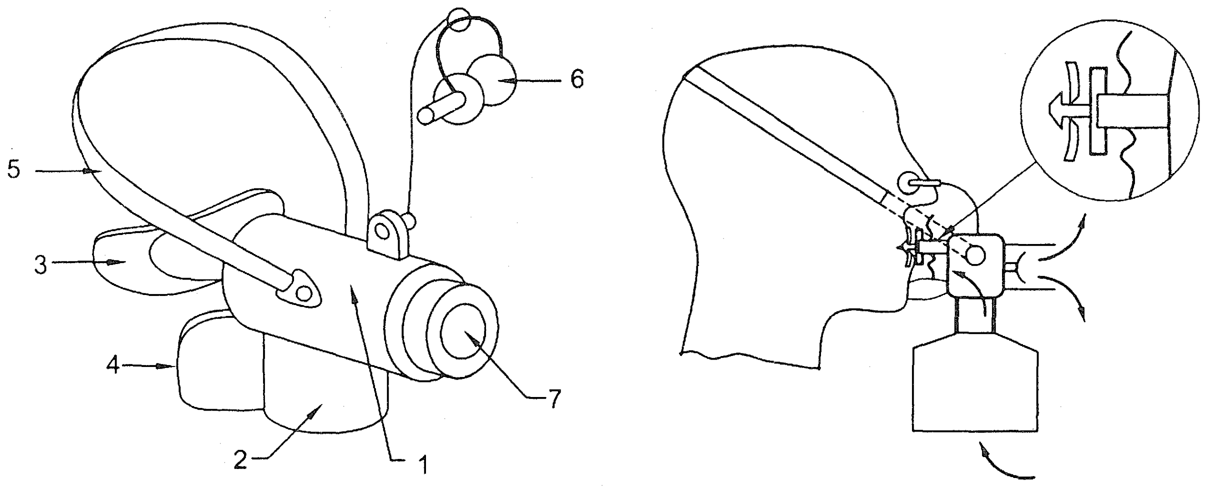
5.1.2 *Half Facepiece*



1 Faceblank
2 Head harness
3 Exhalation valve
4 Inhalation valve
5 Filter housing
6 Equipment connector
7 Particle filter
8 Gas filter
9 Pre-filter
10 Breathing hose
11 Nose piece

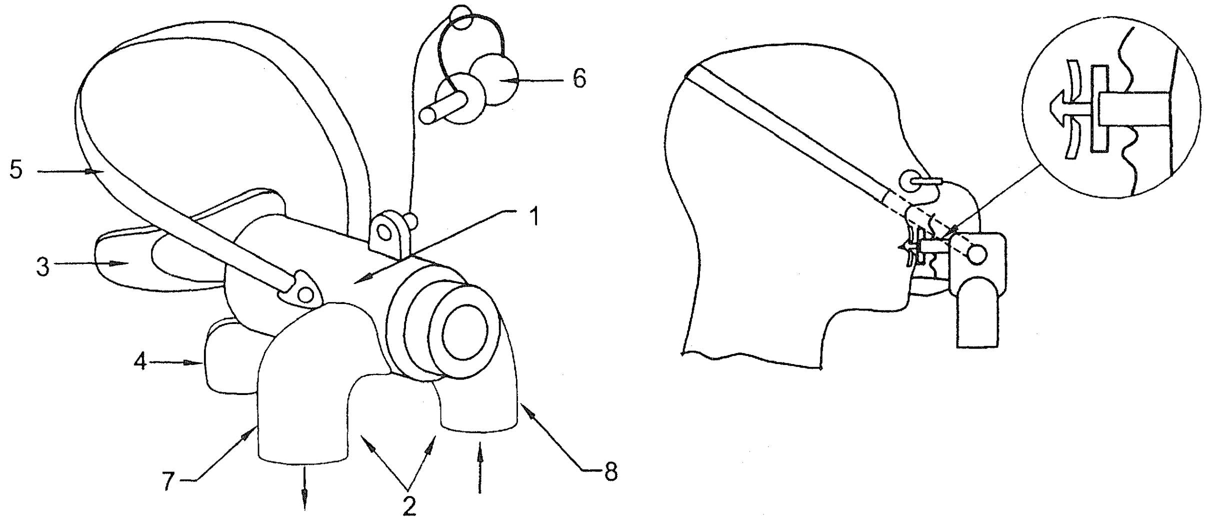
5.1.3 *Mouthpiece Assembly*

5.1.3.1 *For filtering devices and open-circuit breathing apparatus*



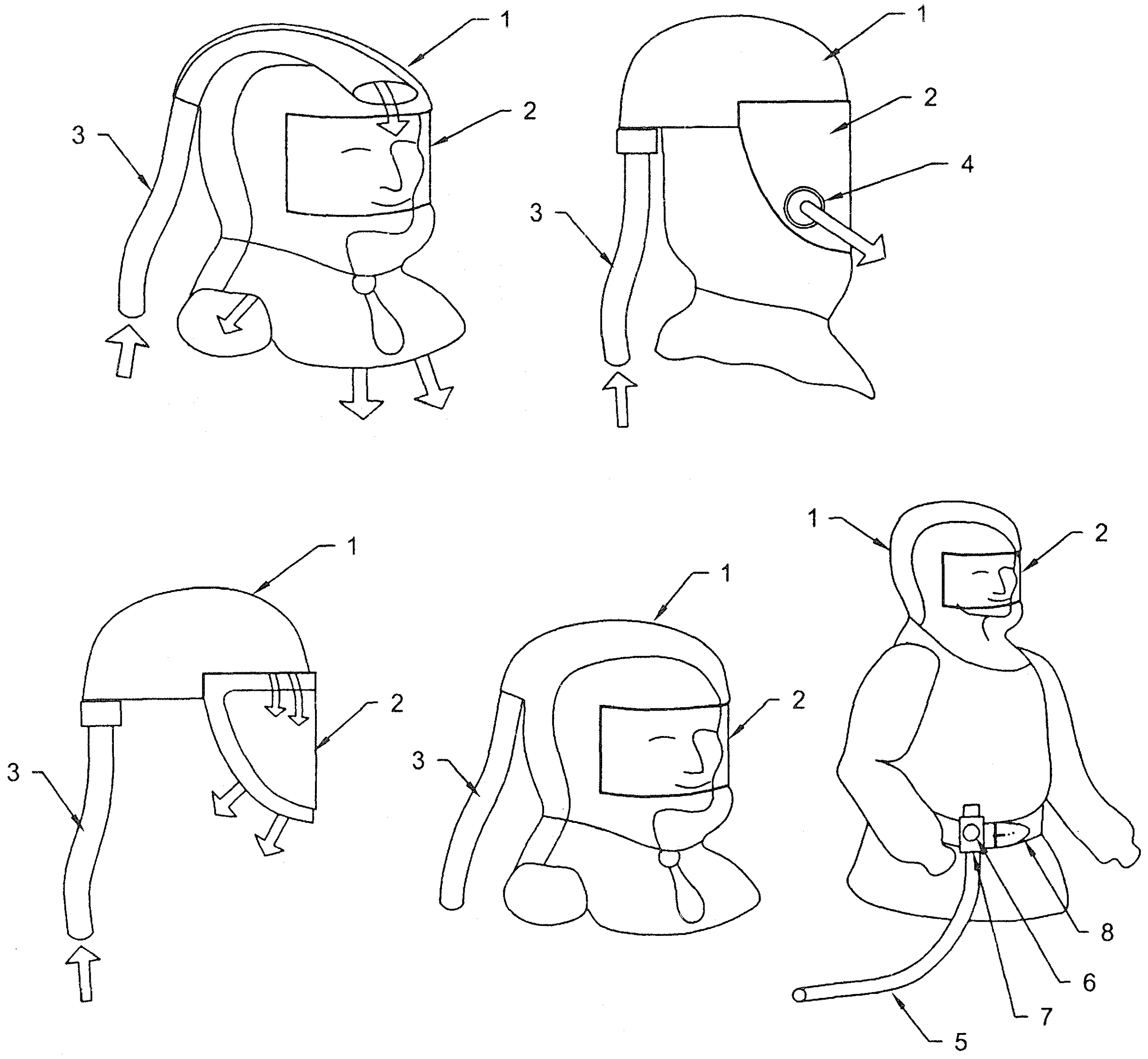
1	Mouthpiece body	5	Head harness
2	Equipment connector	6	Nose clip
3	Mouthpiece	7	Exhalation valve
4	Chin support		

5.1.3.2 *For closed-circuit breathing apparatus*



1	Mouthpiece body	5	Head harness
2	Equipment connector	6	Nose clip
3	Mouthpiece	7	Exhalation valve
4	Chin support	8	Inhalation valve

5.1.4 *Hood, Helmet or Blouse*

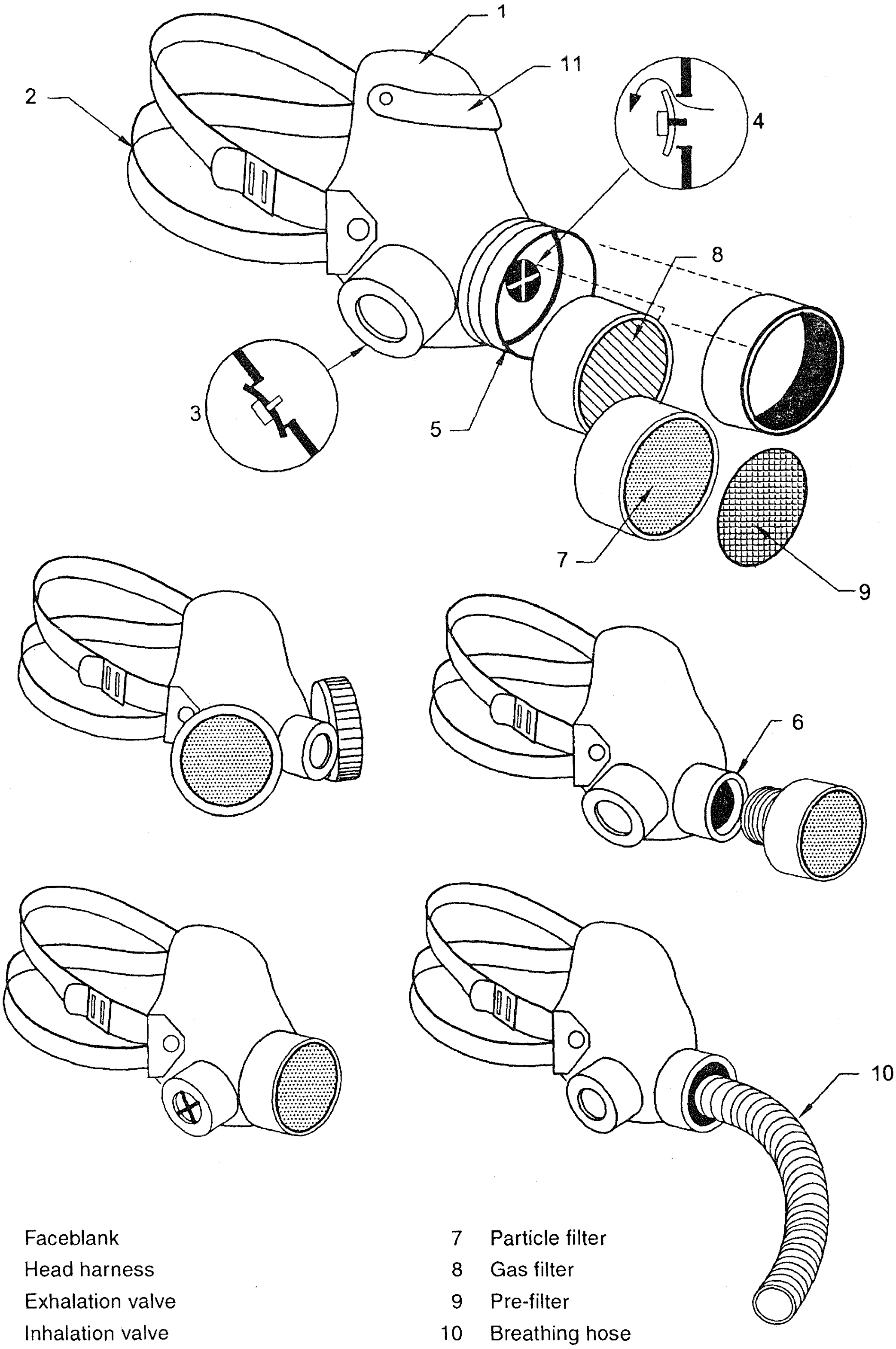


1	Hood, helmet or blouse
2	Visor
3	Breathing hose (Connector)
4	Exhalation valve
5	Compressed air supply tube
6	Continuous flow valve
7	Coupling
8	Waist belt or carrying strap

5.2 Unassisted

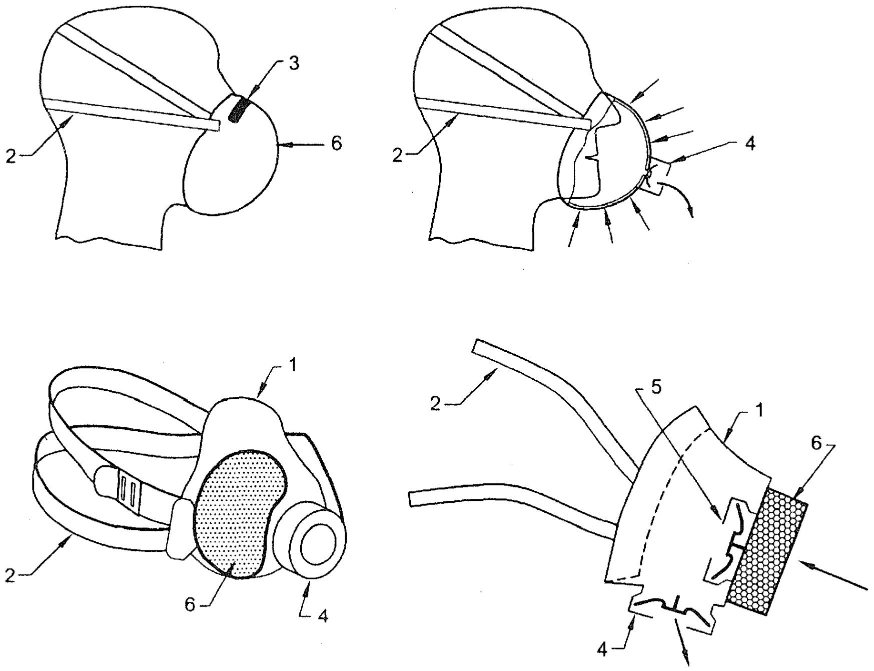
5.2.1 *Unassisted Filtering Devices*

5.2.1.1 *Facepiece and filter*



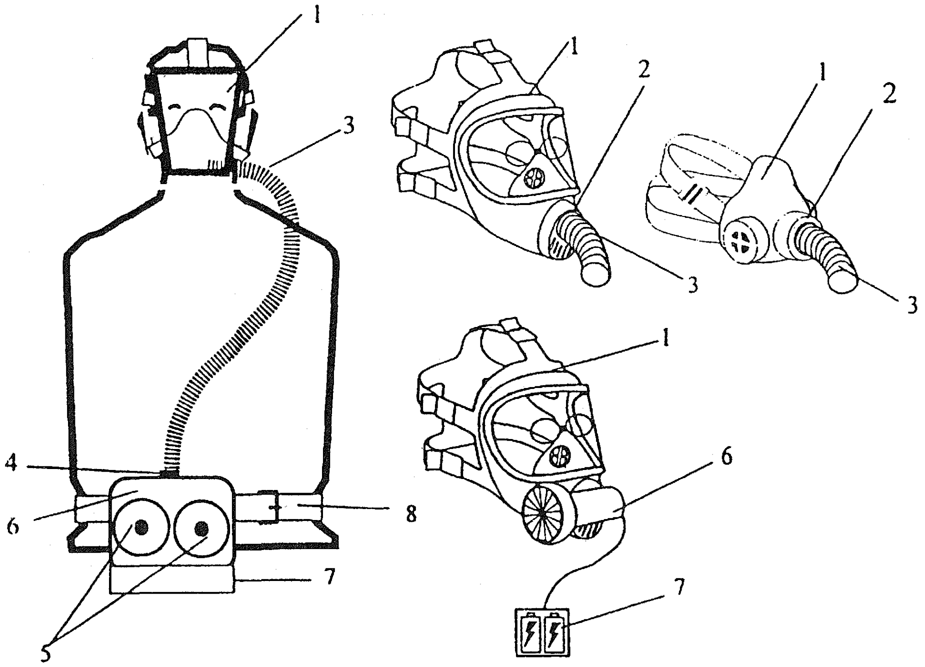
1	Faceblank
2	Head harness
3	Exhalation valve
4	Inhalation valve
5	Filter housing
6	Equipment connector
7	Particle filter
8	Gas filter
9	Pre-filter
10	Breathing hose
11	Nosepiece

5.2.1.2 *Filtering facepiece*



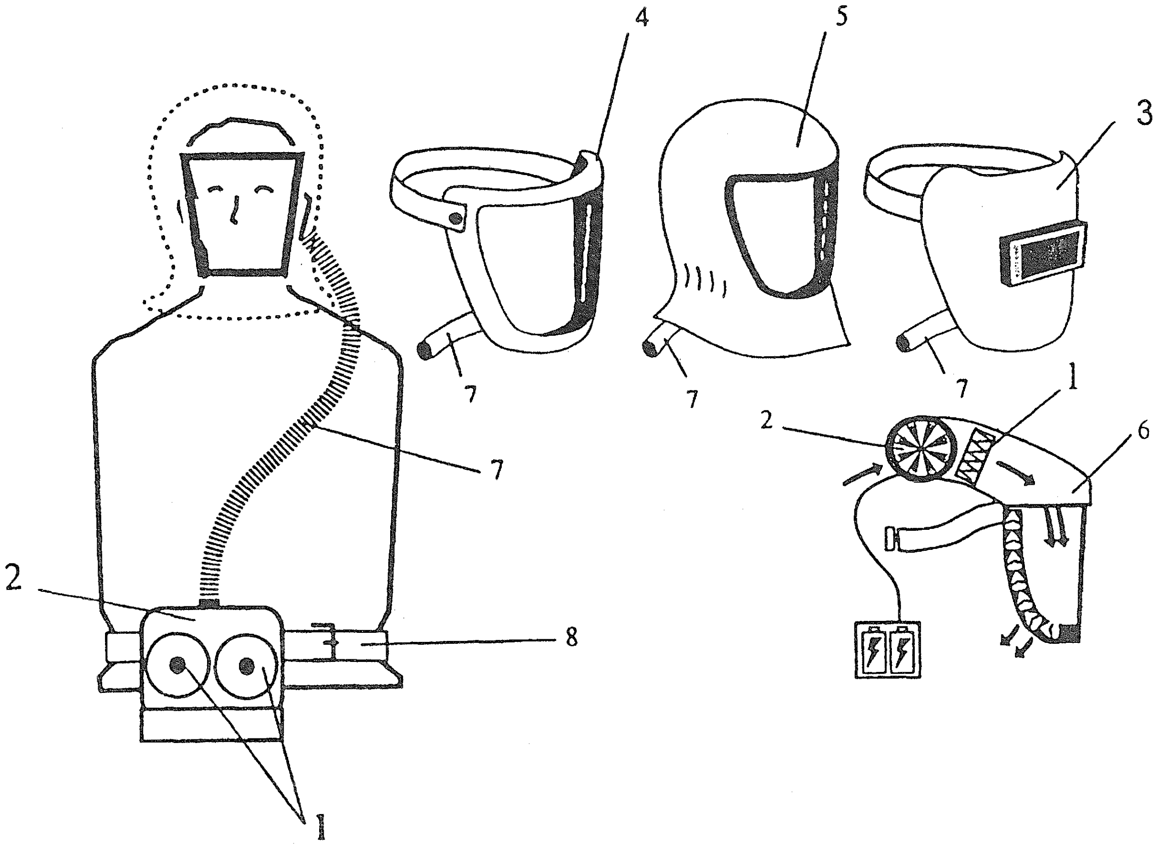
1 Faceblank
2 Head harness
3 Nose piece
4 Exhalation valve
5 Inhalation valve
6 Filter

5.2.2 *Powered Filtering Device (Turbo Filtering Device)*



1 Facepiece
2 Equipment connector
3 Breathing hose
4 Coupling
5 Filter
6 Blower
7 Battery
8 Waist belt or carrying strap

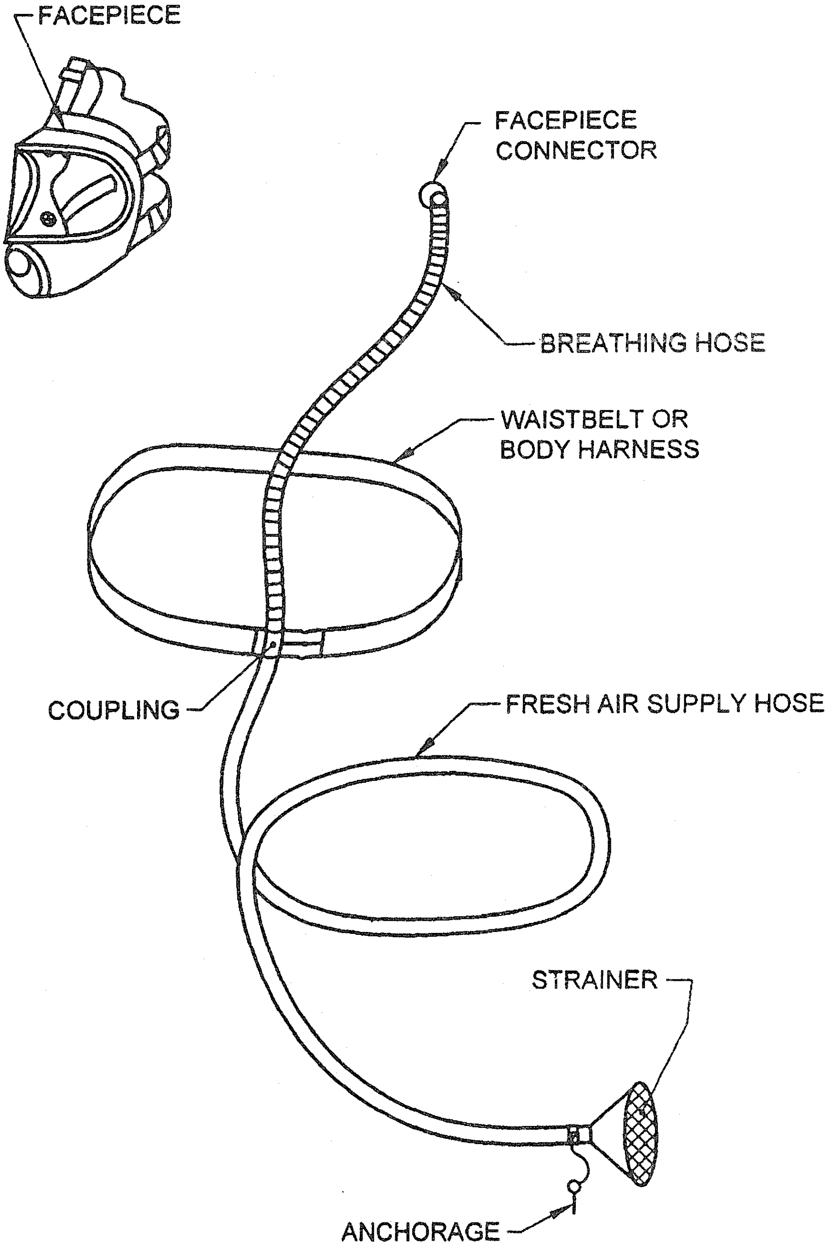
5.2.3 *Powered Filtering Device Incorporating Helmets or Hoods*



1	Filter
2	Blower
3	Welding shield
4	Face shield
5	Hood
6	Helmet
7	Breathing hose
8	Waist belt or carrying strap

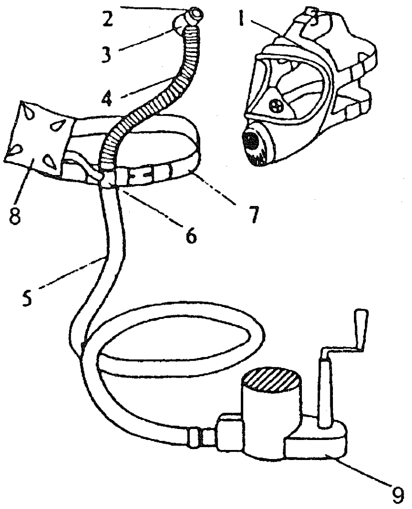
5.3 Breathing Apparatus

5.3.1 *Unassisted Fresh Air Hose Breathing Apparatus*



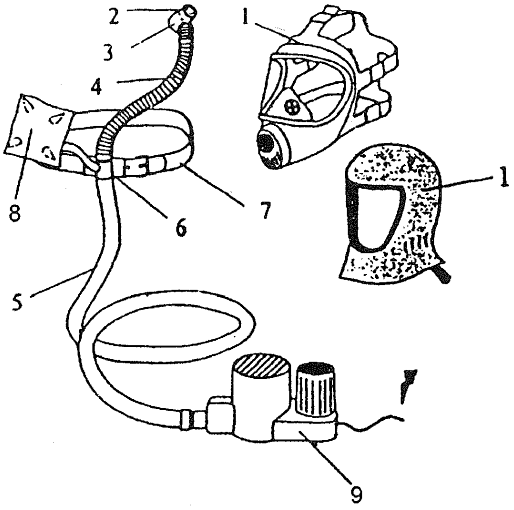
5.3.2 *Assisted Fresh Air Hose Breathing Apparatus*

5.3.2.1 *Manually assisted type*



1 Facepiece
2 Facepiece connector
3 Overflow valve
4 Breathing hose
5 Air supply hose (fresh air supply hose)
6 Coupling
7 Waist belt or body harness
8 Breathing bag
9 Blower (hand operated)

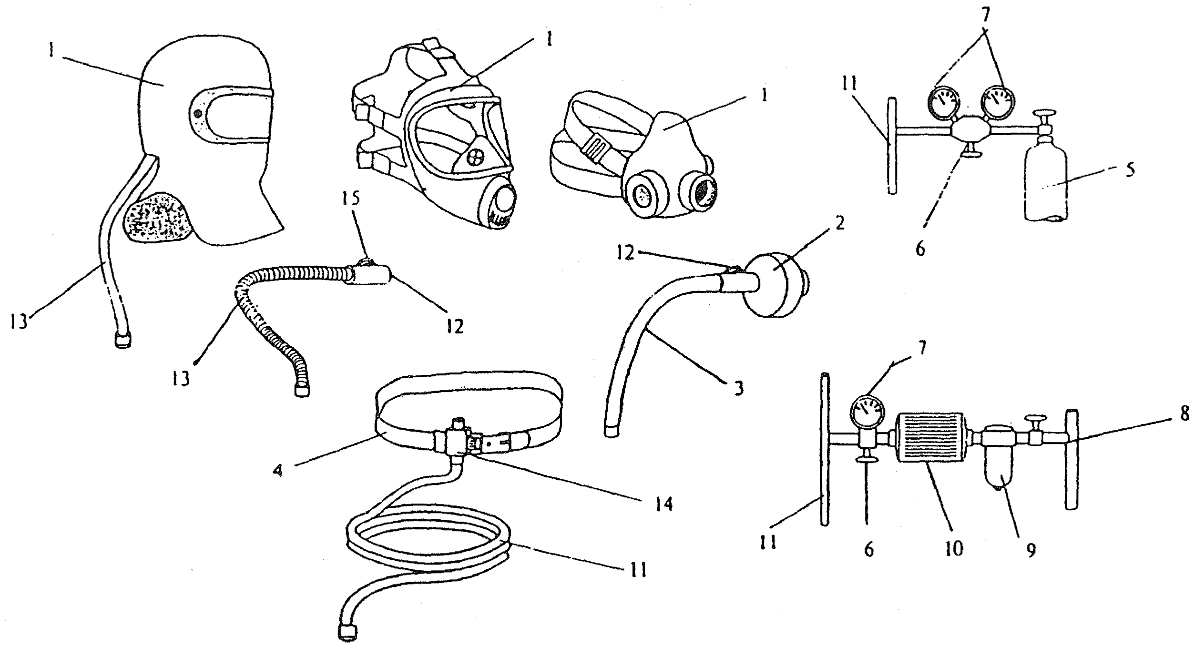
5.3.2.2 *Power assisted type*



1 Facepiece
2 Facepiece connector
3 Overflow valve
4 Breathing hose
5 Air supply hose (fresh air supply hose)
6 Coupling
7 Waist belt or body harness
8 Breathing bag
9 Blower motor driven or compressed air

5.3.3 *Compressed Air Line Breathing Apparatus*

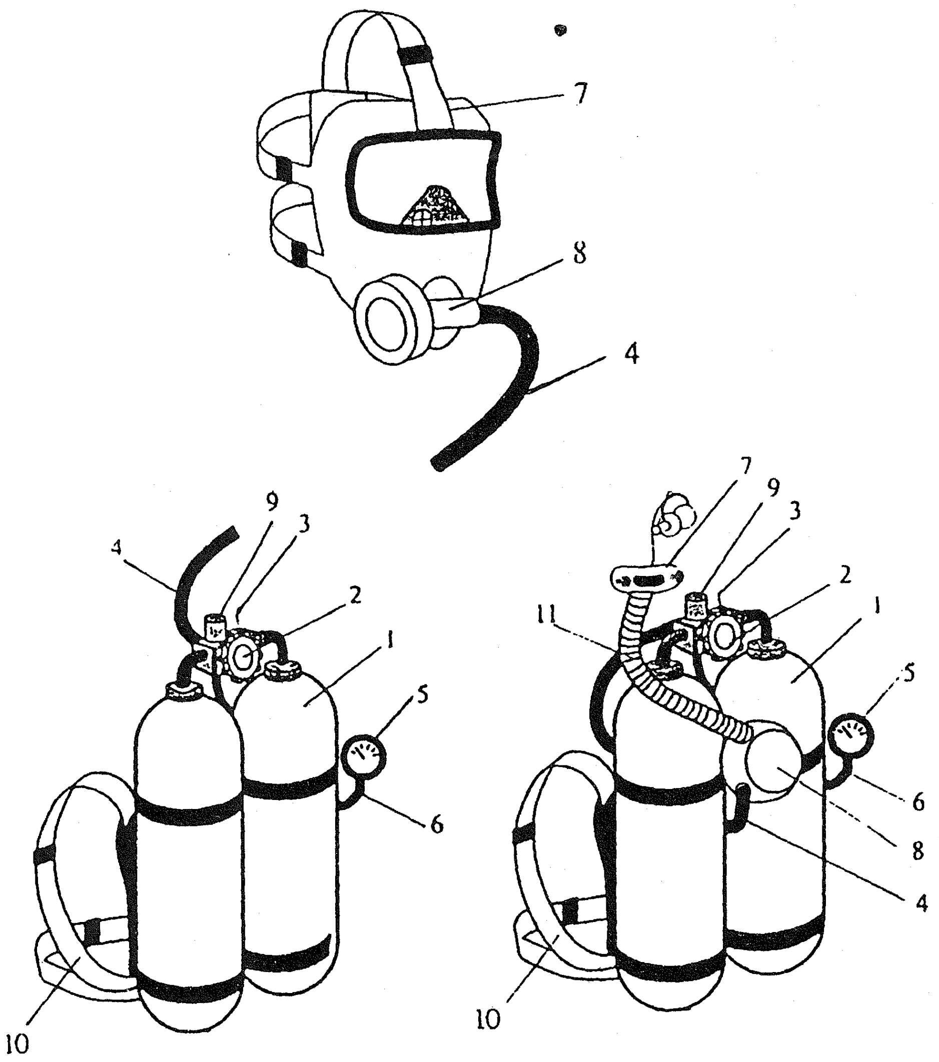
5.3.3.1 *Continuous flow type*



1	Facepiece	9	Separator
2	Demand valve	10	Compressed air filter
3	Medium pressure connecting tube	11	Compressed air supply tube
4	Waist belt or body harness	12	Facepiece connector
5	Compressed air cylinder	13	Breathing hose
6	Pressure reducer	14	Couplings and continous flow valve
7	Pressure gauge	15	Overflow valve
8	Compressed airline		

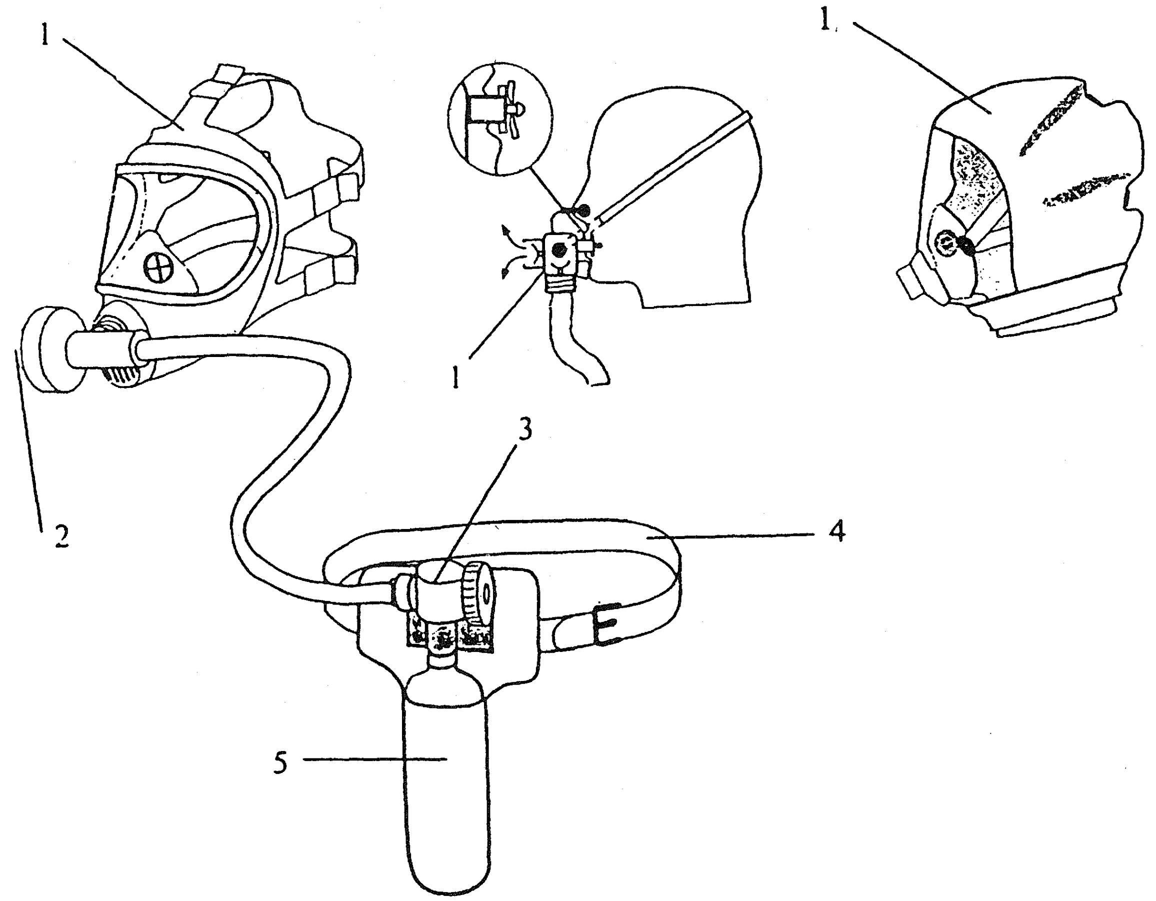
5.3.4 *Self-Contained Open-Circuit Compressed Air Breathing Apparatus*

5.3.4.1 *Demand type*



1	Compressed air cylinder
2	Cylinder valve
3	Pressure reducer
4	Medium pressure connecting tube
5	Pressure gauge
6	Pressure gauge tube
7	Facepiece
8	Demand valve (lung governed)
9	Warning device
10	Body harness
11	Breathing hose

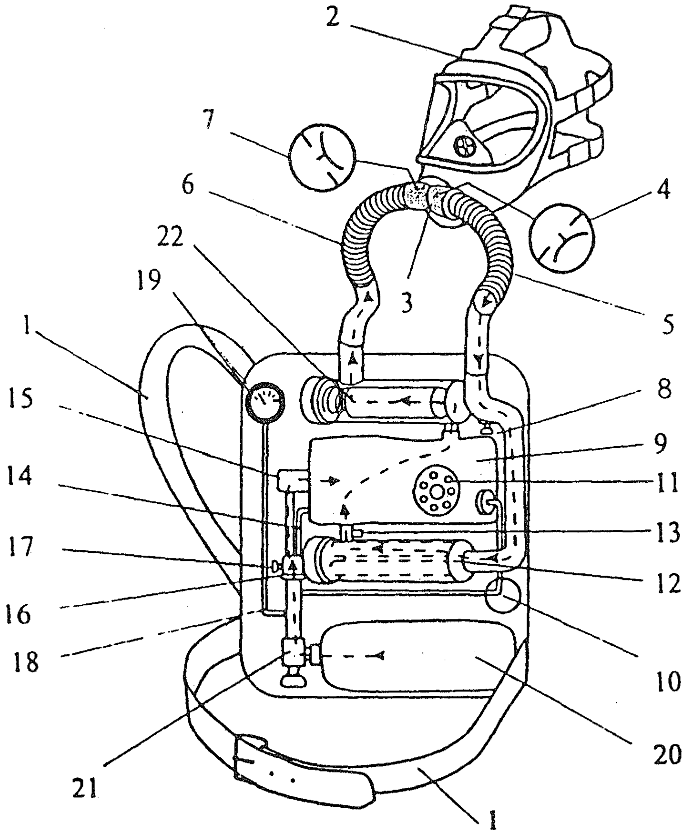
5.3.4.2 *Self-contained open-circuit compressed air breathing apparatus for escape with full face mask or mouthpiece assembly*



1	Facepiece	4	Waist belt
2	Demand valve	5	Compressed air cylinder
3	Pressure transducer		

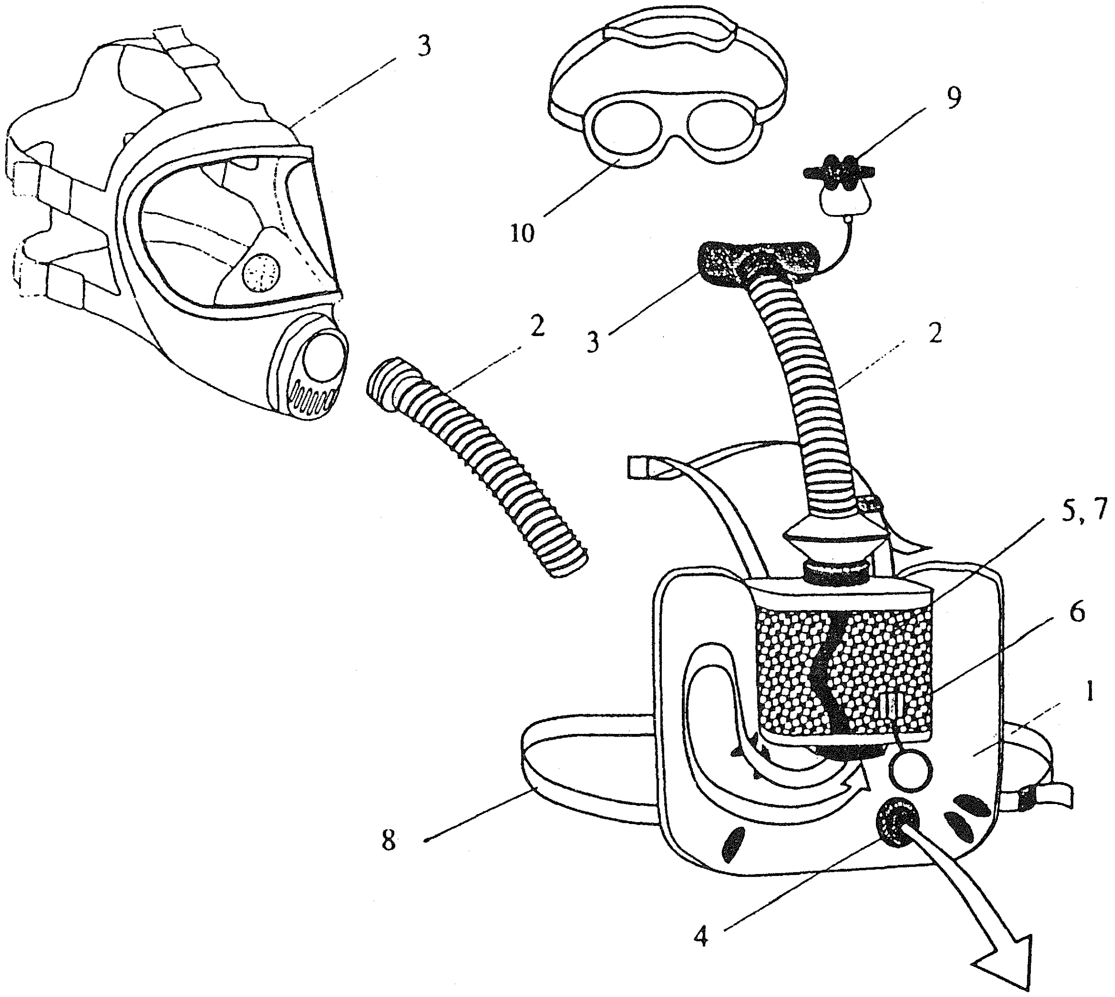
5.3.5 *Self-Contained Closed-Circuit Oxygen Breathing Apparatus*

5.3.5.1 *Compressed oxygen type*



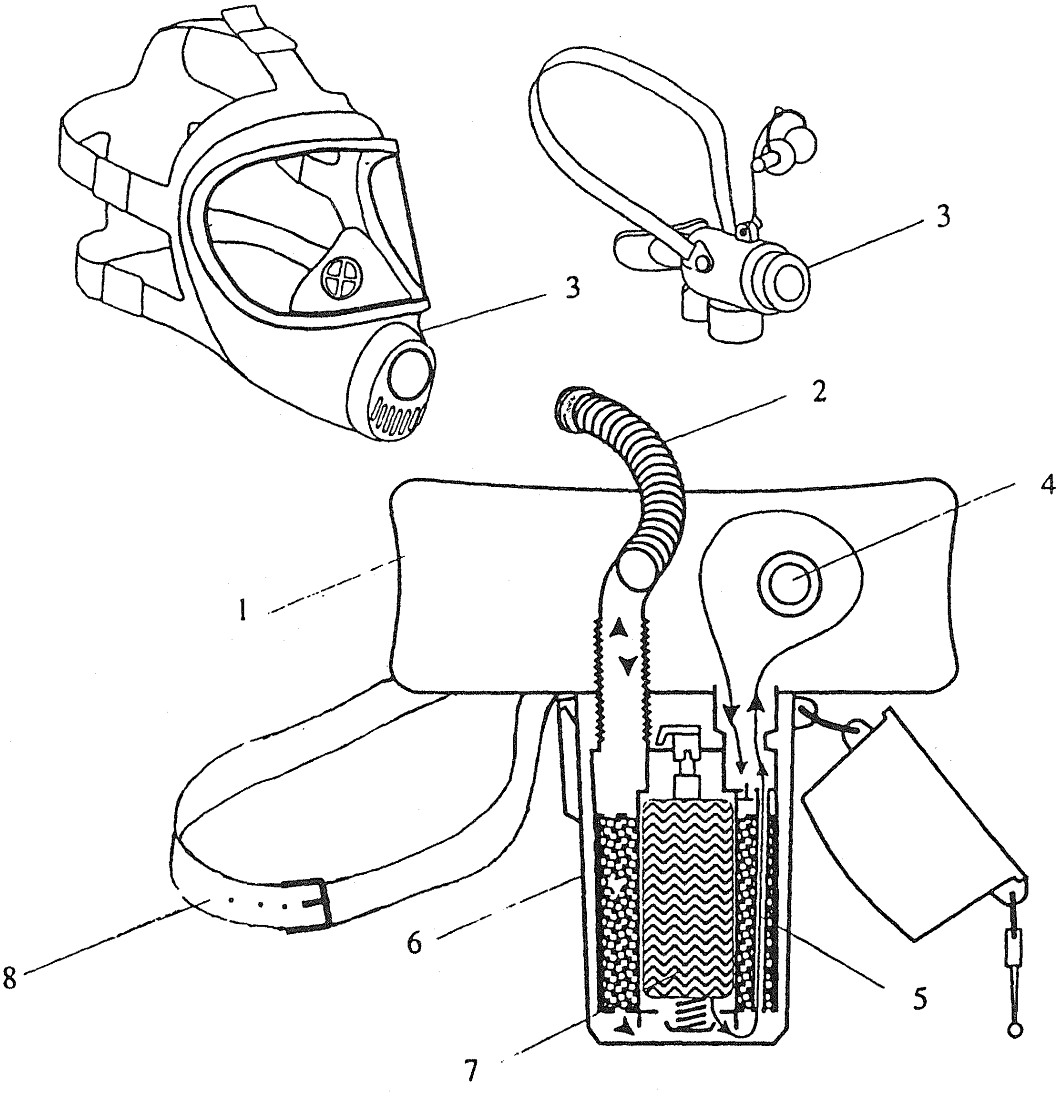
1	Body harness
2	Facepiece
3	Equipment connector
4	Exhalation valve
5	Exhalation hose
6	Inhalation valve
7	Inhalation hose
8	Saliva trap
9	Breathing bag
10	Warning device
11	Relief valve
12	Regeneration cartridge
13	Flushing device
14	Oxygen supply tube
15	Demand valve (lung governed)
16	Pressure reducer
17	Supplementary oxygen supply valve
18	Pressure gauge tube
19	Pressure gauge
20	Oxygen cylinder
21	Cylinder valve
22	Cooler

5.3.5.2 *Selfcontained closed circuit breathing apparatus for self rescue*



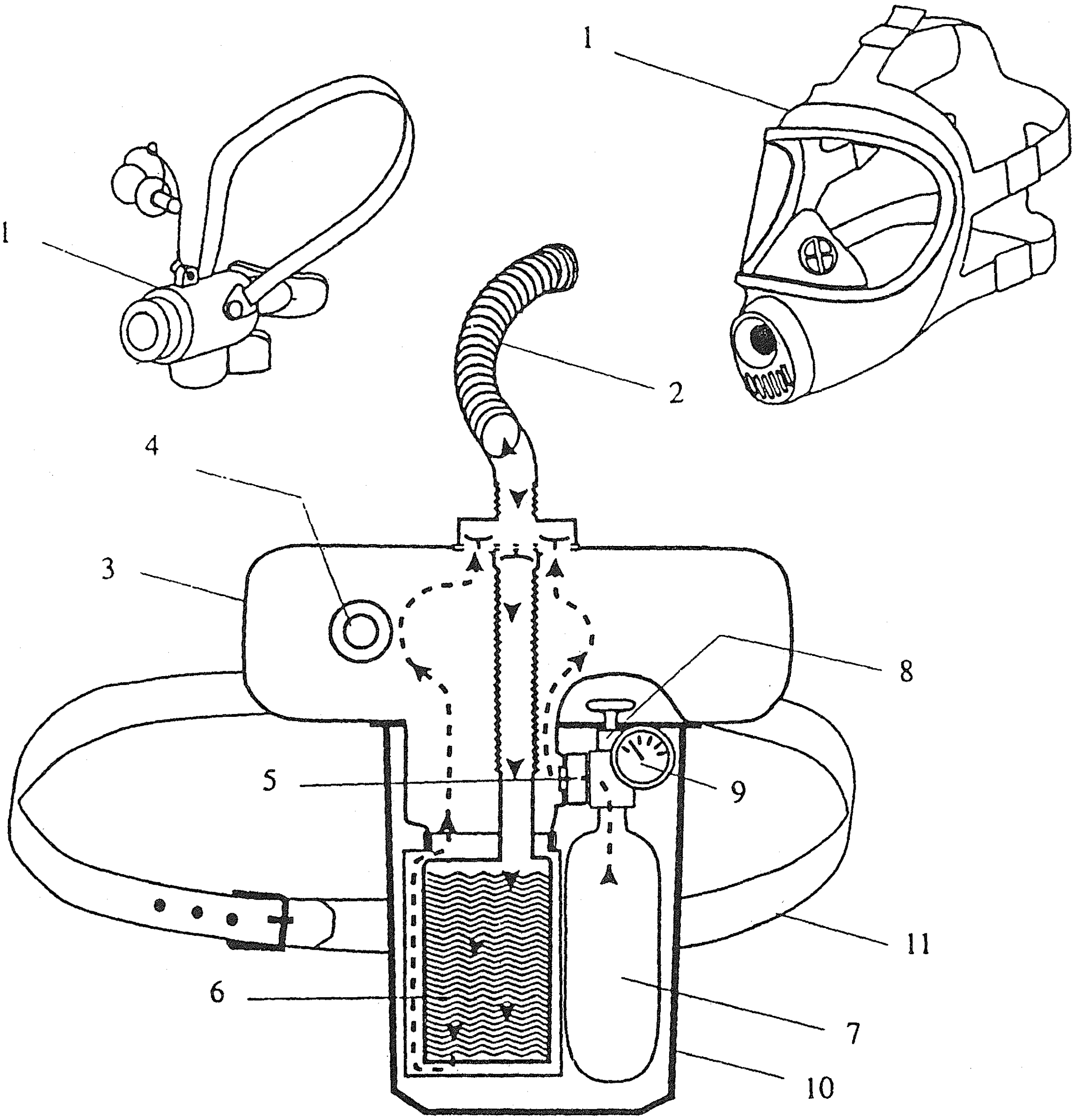
1	Breathing bag
2	Breathing hose
3	Facepiece
4	Relief valve
5	CO_2 absorber
6	Casing
7	O_2 generator
8	Body harness
9	Nose clip
10	Goggles

5.3.5.3 *Chemical oxygen* ($NaClO_3$) *type escape apparatus*



1	Breathing bag
2	Breathing hose
3	Facepiece
4	Relief valve
5	CO_2 absorber
6	Casing
7	O_2 Generator
8	Body harness

5.3.5.4 *Compressed oxygen escape*



1	Facepiece	7	Oxygen cylinder
2	Breathing hose	8	Cylinder valve
3	Breathing bag	9	Pressure gauge
4	Relief valve	10	Casing
5	Pressure reducer	11	Waist belt
6	CO_2 cylinder		

ANNEX A

(*Clauses* 1 *and* 3.8)

COMPOSITION AND PURITY OF BREATHING AIR

A-1 COMPOSITION OF AIR

Air for respiratory protective devices may be natural or synthetic. A typical composition of natural air is given in Table 1.

A-2 AIR QUALITY

Air quality (compressors or cylinders) for supplied air respirators shall meet the requirements specified in Annex A of IS 9623.

Table 1 Composition of Natural Air

(*Clause* A-1)

Components (1)	Mass, Percent (Dry Air) (2)	Vol, Percent (Dry Air) (3)
Oxygen (O_2)	23.14	20.947 6
Nitrogen (N_2)	75.52	78.084
Argon (Ar)	1.288	0.934
Carbon dioxide (CO_2)	0.048	0.031 4
Hydrogen (H_2)	0.000 003	0.000 05
Neon (Ne)	0.001 27	0.001 818
Helium (He)	0.000 073	0.000 524
Krypton (Kr)	0.000 330	0.000 114
Xenon (Xe)	0.000 039	0.000 008 7

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Occupational Safety and Health and Chemical Hazards Sectional Committee, CHD 8

Organization	*Representative(s)*
National Safety Council, Navi Mumbai	Shri K. C. Gupta (***Chairman***)
Airport Authority of India, New Delhi	Shri A. N. Khera Shri M. Durairajan (*Alternate*)
Alkali Manufacturers' Association of India, Delhi	Dr Y. R. Singh
Atomic Energy Regulatory Board, Mumbai	Shri P. K. Ghosh
Bhabha Atomic Research Centre, Mumbai	Shri S. Soundararajan Shri S. D. Bharambe (*Alternate*)
Central Boiler Board, New Delhi	Representative
Central Leather Research Institute, Chennai	Shri G. Swaminathan
Central Mining Research Institute, Dhanbad	Shri J. K. Pandey
Central Warehousing Corporation, New Delhi	Shri F. C. Chadda Shri S. C. Gupta (*Alternate*)
Century Rayon, Thane	Shri H. G. Uttamchandani Shri S. K. Mishra (*Alternate*)
Confederation of Indian Industries, New Delhi	Shri A. K. Ghose Shri Anik Ajmera (*Alternate*)
Consumer Education & Research Centre, Ahmedabad	Dr C. J. Shishoo Shri S. Yellore (*Alternate*)
Department of Industrial Policy and Promotion, New Delhi	Dr D. R. Chawla
Department of Space (ISRO), Sriharikota	Shri K. Vishwanathan Shri V. K. Srivastava (*Alternate*)
Directorate General Factory Advice Service and Labour Institute, Mumbai	Dr A. K. Majumdar Shri H. Vishwanathan (*Alternate*)
Directorate General of Health Services, New Delhi	Dr P. H. Anathanarayanan Dr A. N. Sinha (*Alternate*)
Directorate General of Mines Safety, Dhanbad	Director of Mines (MSE) Deputy Director of Mines Safety (HQ) (*Alternate*)

Organization	*Representative(s)*
Directorate of Industrial Safety and Health, Mumbai	Shri S. D. Jagtap
Directorate of Standardization, Ministry of Defence, New Delhi	Shri P. S. Ahuja Lt-Col Tejinder Singh (*Alternate*)
Employees State Insurance Corporation, New Delhi	Dr A. M. Patil Dr G. N. Bankapur (*Alternate*)
Hindustan Aeronautics Limited, Bangalore	Shri S. V. Suresh
Hindustan Lever Limited, Mumbai	Shri B. B. Dave Shri Aditya Jhavar (*Alternate*)
Indian Association of Occupational Health, Bangalore	Representative
Indian Chemical Manufacturers Association, Mumbai	Shri Prakash Wagle Shri A. A. Panjwani (*Alternate*)
Indian Institute of Chemical Technology, Hyderabad	Shri K. V. Ramanayya
Indian Institute of Safety and Environment, Chennai	Dr M. Rajendran Dr G. Venkatarathnam (*Alternate*)
Indian Petrochemical Corporation Ltd, Vadodara	Shri P. Vijayraghavan Shri M. R. Patel (*Alternate*)
Indian Toxicological Research Centre, Lucknow	Dr Virendra Mishra Dr V. P. Sharma (*Alternate*)
Ministry of Defence (DGQA), New Delhi	Shri M. S. Sultania Shri Sujit Ghosh (*Alternate*)
Ministry of Defence (R&D), Kanpur	Dr A. K. Saxena Dr Rajindra Singh (*Alternate*)
Ministry of Environment & Forests, New Delhi	Representative
Ministry of Home Affairs, New Delhi	Shri Om Prakash Shri D. K. Shami (*Alternate*)
National Institute of Occupational Health, Ahmedabad	Dr H. R. Rajmohan Dr A. K. Mukherjee (*Alternate*)
National Safety Council, Navi Mumbai	Shri P. M. Rao Shri D. Biswas (*Alternate*)
NOCIL, Mumbai	Dr B. V. Bapat Shri V. R. Narla (*Alternate*)
Office of the Development Commissioner (SSI), New Delhi	Shri Mathura Prasad Shrimati Sunita Kumar (*Alternate*)
Oil Industry Safety Directorate (Ministry of Petroleum & Natural Gas), Delhi	Shri Shashi Vardhan Shri S. C. Gupta (*Alternate*)
Ordnance Factory Board, Kolkata	Dr D. S. S. Ganguly Shri R. Srinivasan (*Alternate*)
Petroleum & Explosives Safety Organization, Nagpur	Joint Chief Controller of Explosives
Safety Appliances Manufacturers Association, Mumbai	Shri M. Kant Shri Kirit Maru (*Alternate*)
SIEL Chemical Complex, New Delhi	Shri N. S. Birdie Shri Rabindra Nath Sahu (*Alternate*)
Southern Petrochemical Industries Corporation Ltd, Chennai	Shri V. Jayaraman Shri S. Muruganandam (*Alternate*)
Steel Authority of India Ltd, Ranchi	Shri V. K. Jain
Tata AIG Risk Management Services Ltd, Mumbai	Shri Urmish D. Shah
Tata Chemicals Ltd, Mithapur, Dist Jamnagar	Shri Sanjiv Lal Shri M. C. Agrawal (*Alternate*)
BIS Directorate General	Shri E. Devendar, Scientist 'F' & Head (CHD) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri N. K. Pal
Scientist 'E' (CHD), BIS

Occupational Safety and Health Subcommittee, CHD 8 : 1

Organization	*Representative(s)*
National Safety Council, Navi Mumbai	Shri P. M. Rao (***Convener***)
Airport Authority of India, New Delhi	Shri H. S. Rawat
Atomic Energy Regulatory Board, Mumbai	Shri V. V. Pande
Bhabha Atomic Research Centre, Mumbai	Shri S. D. Bharambe Shri A. P. Sathe (*Alternate*)
Central Mining Research Institute (CSIR), Dhanbad	Shri J. K. Pandey
Centre for Fire, Explosives & Environment Safety, Delhi	Km Arti Bhatt Dr K. Kadirrelu (*Alternate*)
Coal India Limited, Kolkata	Shri S. C. Pal Shri S. C. Roy Choudury (*Alternate*)
Department of Defence Production (DGQA), New Delhi	Shri M. S. Sultania Shri B. Ghosh (*Alternate*)
Department of Space (ISRO), Bangalore	Shri K. Vishwanathan Shri V. K. Srivastava (*Alternate*)
Directorate General Factory Advice Services & Labour Institute, Mumbai	Dr P. P. Lanjewar Dr Brij Mohan (*Alternate*)
Indian Chemical Manufacturers Association, Mumbai	Dr M. S. Ray Dr S. H. Namdas (*Alternate*)
Indian Telephone Industries Ltd, Bangalore	Shri P. Jayaprakash Shri C. Mahalingam (*Alternate*)
Industrial Toxicological Research Centre, Lucknow	Dr A. K. Srivastava Dr S. K. Rastogi (*Alternate*)
Joseph Leslie & Co, Mumbai	Shri Vinod Bamaniya Shri Sameer Dange (*Alternate*)
Joseph Leslie Drager Manufacturing Private Ltd, Mumbai	Shri Cyril Pereira Shri Hirendra Chatterjee (*Alternate*)
3M India Limited, Bangalore	Shri Abhijeet Arun Saungikar Shri Viren Shah (*Alternate*)
National Fire Service College, Nagpur	Representative
National Institute of Occupational Health, Ahmedabad	Dr H. R. Rajmohan Dr A. K. Mukerjee (*Alternate*)
National Mineral Development Corporation Ltd, Hyderabad	Shri D. Vidyarthi
Oil Industry Safety Directorate, New Delhi	Shri Shashi Vardhan Shri S. C. Gupta (*Alternate*)
PN Safetech Private Limited, Lucknow	Shri Rajesh Nigam Shri Anil Kumar Srivastava (*Alternate*)
Reliance Industries Limited, Mumbai	Shri N. K. Valecha Shri S. G. Patel (*Alternate*)
Safety Appliances Manufacturers Association, Mumbai	Shri M. Kant Shri Kirit Maru (*Alternate*)
Steel Authority of India, Ranchi	Shri V. K. Jain
Vishvesvara Enterprises, Navi Mumbai	Shri Mahesh Kudav Shri Ravi Shinde (*Alternate*)
Voltech (India), Delhi	Shri Pawan Kumar Pahuja Km Meenakshi Pahuja (*Alternate*)